

NEW RECORDS OF PHYTOPLANKTON FOR BANGLADESH. 4. CHLOROCOCCALES

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Abstract

This study presents three species from each of *Schroederia*, *Monoraphidium* and *Ankistrodesmus*, two species and one variety of *Dictyosphaerium*, two varieties of *Pediastrum*, and *Tetraedron arthrodesmiiforme* var. *contorta*, *Chlorotetraedron polymorphum*, *Myrmecia aquatica*, *Oocystis tainoensis*, *Nephrocytium spirale*, *Kirchneriella irregularis*, *Coelastrum indicum* and *Scenedesmus similagineus*. These taxa have been reported from some ponds of Mathbaria of Pirojpur and Bakerganj of Barisal Districts in Bangladesh.

Introduction

Chlorococcales comprises a large number of species which are predominantly aquatic and found to be most common in occurrence in samples of phytoplankton. They are mostly unicellular but may form colonies of rather definite shape. All of them have a characteristic in common that they are unable to multiply via vegetative cell division. At vegetative state the multiplication is generally carried out by autospore formation (Prescott 1982, Huber-Pestalozzi 1983).

In Bangladesh, Islam and Khatun (1966) first reported some species of Chlorococcales from some polluted waters of Dhaka city. Later on, Islam and Begum (1970) performed another voluminous work on this order from Dhaka district. Few more research works carried out in the later period have also added to the new reports for this group (e.g., Islam 1969, 1973, Islam and Saha 1975, Islam and Zaman 1975, Islam and Aziz 1977, 1979, 1987, Islam and Khair 1978, Chowdhury and Khair 1983, Islam and Begum 1987, Islam and Alfasane 2001, Islam and Irfanullah 2001) and the total number of species so far reported is about 250.

In the present study, 22 taxa of Chlorococcales have been newly recorded for Bangladesh. The taxa were encountered in the plankton samples collected from different pond ecosystems of Mathbaria of Pirojpur District and Bakerganj of Barisal District between 2004 and 2006. New reports of phytoplankton for Bangladesh belonging to

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Cyanophyceae, Cryptophyceae, Xanthophyceae, Synurophyceae and the members of the order Volvocales from the same study areas have been published elsewhere (Khondker *et al.* 2006, 2007a,b).

Materials and Methods

Plankton concentrates, obtained by passing and sedimenting a definite volume of sample water through plankton net and by Lugol's solution in Pyrex glass bottle, respectively, were used for the present systematic analyses. The sampling was carried out from 1-8 and 1-6 permanent stations of Bakerganj and Mathbaria, respectively, in between 2004 and 2006. Details of the sampling procedure and descriptions of the sites have been published in Khondker *et al.* (2006).

Taxonomic enumeration

Twenty-two taxa of Chlorococcales belonging to eight families were identified from the pelagic plankton communities of different ponds of Mathbaria and Bakerganj. An illustrated account of these species is presented in this paper. For the systematic arrangement, Huber-Pestalozzi (1983) has been followed.

Division: Chlorophyta; Class: Chlorophyceae; Order: Chlorococcales

Family: Palmellaceae

1. **Chlorotetraedron polymorphum** (Mac Entee, F.J., H.C. Bold & P.A. Archibald)
Mac Entee, F.J., H.C. Bold & P.A. Archibald [Syn.: *Pseudotetraedron polymorphum*
Mac Entee, F.J., H.C. Bold & P.A. Archibald] **(Figs. 1a-c)**
(Huber-Pestalozzi 1983, 128, 34: 12c)

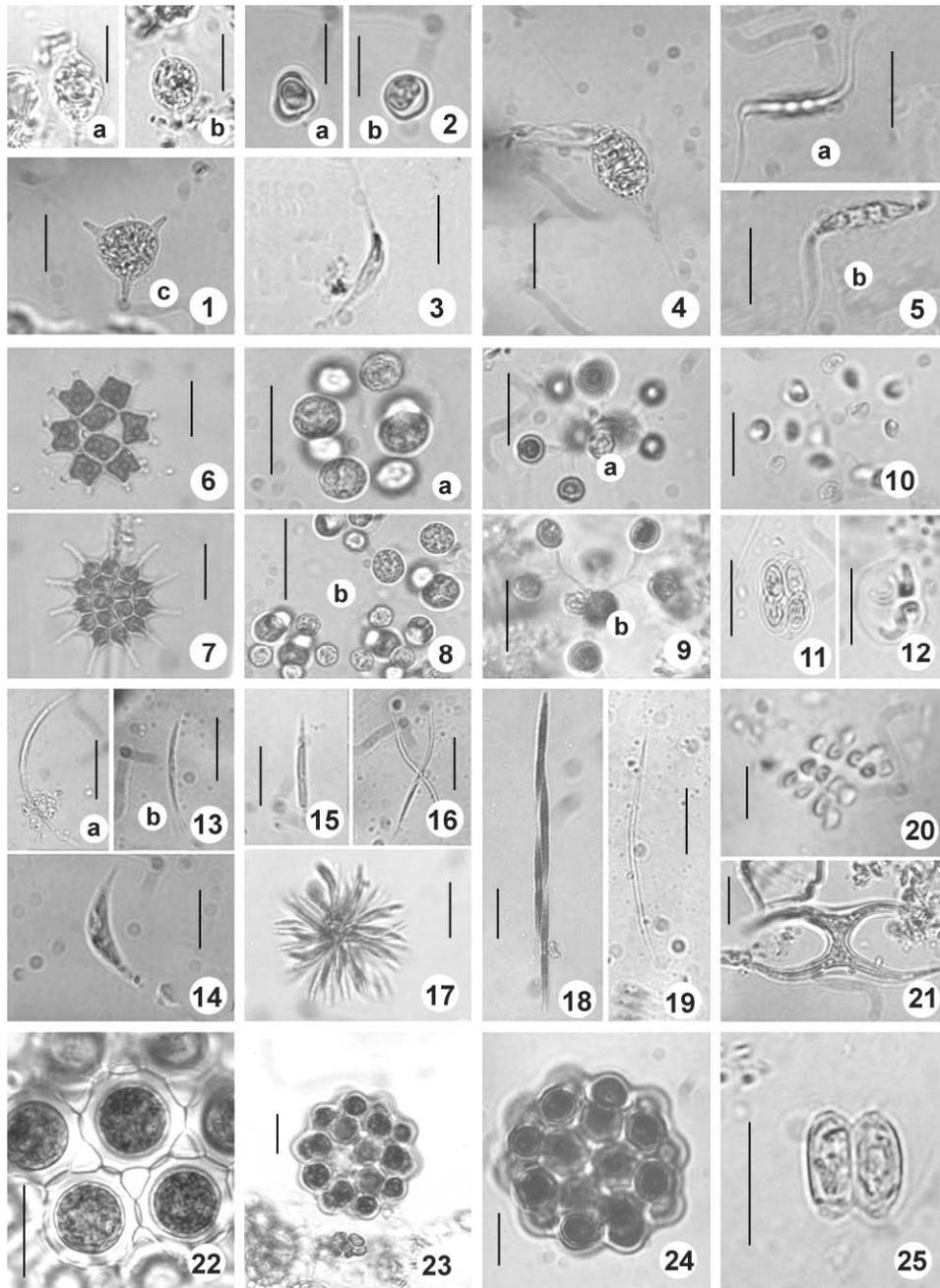
Cells solitary, somewhat tetrahedral or polyhedral. Chloroplast single, lying in close contact with the cell wall, pyrenoid single, seldom many. Cells 10-19 μm in diameter, without processes, process 4 μm long.

Bakerganj, Station No. 4, 09.08.2004, Station No. 8, 06.09.2004.

2. **Myrmecia aquatica** G.M. Smith **(Figs. 2a-b)**
(Huber-Pestalozzi 1983, 144, 41: 3)

Cells solitary, ovoid, spherical, sometimes irregularly pyriform. Cell wall thin with mamillate thickening on one side. Chloroplast parietal, placed little away from the mamillate margin. Cells 8-10 μm in diameter.

Mathbaria, Station No. 1, 16.08.2004.



Figs. 1-25. 1a-c. *Chlorotetraedron polymorphum*, 2a-b. *Myrmecia aquatica*, 3. *Schroederia antillarum*, 4. *S. planctonica*, 5a-b. *S. spiralis*, 6. *Pediastrum boryanum* var. *brevicorne*, 7. *P. simplex* var. *sturmii*, 8a-b. *Dictyosphaerium granulatum*, 9a-b. *D. pulchellum* var. *minutum*, 10. *D. tetrachotomum*, 11. *Oocystis tainoensis*, 12. *Nephrocytium spirale*, 13a-b. *Monoraphidium arcuatum*, 14. *M. fontinale*, 15. *M. tortile*, 16-17. *Ankistrodesmus bernardii*, 18. *A. densus*, 19. *A. stipitatus*, 20. *Kirchneriella irregularis*, 21. *Tetraedron arthrodesmiforme* var. *contorta*, 22-24. *Coelastrum indicum*, 25. *Scenedesmus similagineus*. (Bar = 10 μ m)

Family: Characiaceae

3. **Schroederia antillarum** Kom. (Fig. 3)
 (Huber-Pestalozzi 1983, 251, 74: 2)
 Cells solitary, pale green in color, elongated spindle, curved; both the cell ends straight, hyaline and sharply pointed. Cells with pointed ends 25 μm long and 2 μm wide.
 Bakerganj, Station No. 8, 09.08.2004.
4. **Schroederia planctonica** (Skuja) Philipose [Syn.: *Characium planktonicum* Skuja] (Fig. 4)
 (Huber-Pestalozzi 1983, 250, 72: 3f)
 Cells solitary, pale green in color, spindle-shaped, central portion bulged out, tips sharply pointed, thin, elongated, both the cell ends almost straight. Chloroplast with 1-2 or later on more pyrenoids. Mother cells show laterally divided protoplasts probably prior to the zoospore production. Cells without pointed ends 15 \times 11 μm , ends 23 μm long.
 Bakerganj, Station No. 8, 29.11.2004.
5. **Schroederia spiralis** (Printz) Korš. [Syn.: *Ankistrodesmus nitzschioides* var. *spiralis* Printz.] (Figs. 5a-b)
 (Huber-Pestalozzi 1983, 252, 74: 4b)
 Cells solitary, pale green in color, spindle-shaped. Both the cell ends sharply pointed and spirally bent. Chloroplasts lie adjacent to the cell walls, parietal, with distinct pyrenoids. Cells including spiral ends 35 μm long and 3 μm in diameter.
 Mathbaria, Station No. 1, 30.08.2004.

Family: Hydrodictyaceae

6. **Pediastrum boryanum** var. **brevicorne** A. Br. (Fig. 6)
 (Huber-Pestalozzi 1983, 296, 86: 5c)
 Coenobia mostly compact and without perforation, (a single perforation is evident in the present specimen), 8-32-celled, cell wall lightly granulated, peripheral cells with two stubby processes, central cells nearly quadrangular. Coenobia 30.6 μm in diameter; individual cells 11.4 \times 10.2 μm .
 Mathbaria, Station No. 4, 04.07.2005.
7. **Pediastrum simplex** var. **sturmii** (Reinsch) Wolle [Syn.: *Pediastrum sturmii* Reinsch] (Fig. 7)
 (Huber-Pestalozzi 1983, 288, 84: 2b)

Coenobia without perforation, 16-celled, cell wall regularly granulated, each peripheral cell with a single medium-sized process, central cells nearly quadrangular. Coenobia 38 μm in diameter. Peripheral cells $12.7 \times 5.1 \mu\text{m}$; central cells $4.6 \times 3.5 \mu\text{m}$.

Mathbaria, Station No. 4, 04.07.2005.

Family: Botryococcaceae

8. **Dictyosphaerium granulatum** Hind. (Figs. 8a-b)

(Huber-Pestalozzi 1983, 354, 106: 1c)

Colonies 4-16-celled, seldom with more cells, surrounded by a colorless mucilage sheath. Cells ovoid, broadly ovoid or spherical. Chloroplast single, bowl-shaped, pyrenoid present. Cell wall yellowish to brown, beset with irregularly arranged granules. Colonies $37 \times 32 \mu\text{m}$; individual cells 5 μm in diameter.

Mathbaria, Station No. 6, 30.08.2004.

9. **Dictyosphaerium pulchellum** var. **minutum** Defl. (Figs. 9a-b)

(Huber-Pestalozzi 1983, 354, 105: 3)

Colonies 4-16-celled, cells spherical, mucilage envelope not visible, cells loosely arranged. Cells 5 μm in diameter.

Mathbaria, Station No. 3, 11.10.2004.

10. **Dictyosphaerium tetrachotomum** Printz (Fig. 10)

(Huber-Pestalozzi 1983, 355, 107: 2)

Colonies free swimming, mostly irregular, approximately 30 μm in diameter, no mucilage envelope. Cells weakly ovoid to spherical. Chloroplast single, lateral, bowl-shaped, always with a pyrenoid. Individual cells 3 μm in diameter.

Bakerganj, Station No. 2, 15.06.2004.

Family: Oocystaceae

11. **Oocystis tainoensis** Kom. (Fig. 11)

(Huber-Pestalozzi 1983, 501, 20: 1)

Cells elliptical, ends bluntly pointed, very seldom single, mostly 2-4-16-celled colonies. Polar thickenings invisible, in younger cells pyrenoid present. Colonies $14 \times 8 \mu\text{m}$, individual cells $5 \times 3 \mu\text{m}$.

Mathbaria, Station No. 6, 22.06.2004.

12. **Nephrocytium spirale** Beck-Mannag. (Fig. 12)

(Huber-Pestalozzi 1983, 538, 157: 3)

Colonies 4-8-celled, elliptic to oval. Cells spiral, more or less cylindrical, curved or screw-like, embedded in a colorless mucilage. Colonies $12 \times 10 \mu\text{m}$, individual cells $5 \mu\text{m}$ long (under curved condition) and $1.5 \mu\text{m}$ broad.

Bakerganj, Station No. 2, 15.06.2004.

Family: Chlorellaceae

13. **Monoraphidium arcuatum** (Korš.) Hind. [Syn.: *Ankistrodesmus arcuatus* Korš.]

(Huber-Pestalozzi 1983, 634, 177: 3) (Figs. 13a-b)

Cells solitary, thin, spindle-shaped, more than 20 times longer than broad, ends gradually narrowed to a sharp point, curved like a circle. Chloroplast lie adjacent to the cell wall, pyrenoid absent. Cells $25\text{-}30 \mu\text{m}$ long (under curved condition), about $1.0\text{-}1.5 \mu\text{m}$ broad.

Mathbaria, Station No. 1, 24.05.2004; Bakerganj, Station No. 2, 15.06.2004.

14. **Monoraphidium fontinale** Hind. (Fig. 14)

(Huber-Pestalozzi 1983, 632, 177: 26)

Cells solitary, elongated spindle, almost straight to lightly curved, ends not so sharply pointed. Cell wall hyaline, smooth. Chloroplast lie adjacent to the cell wall, pyrenoid absent. Cells $20 \mu\text{m}$ long, about $5 \mu\text{m}$ broad.

Mathbaria, Station No. 1, 30.08.2004.

15. **Monoraphidium tortile** (W. & G.S. West) Kom.-Legn. [Syn.: *Ankistrodesmus tortilis* W. & G. West] (Fig. 15)

(Huber-Pestalozzi 1983, 631, 176: 2)

Cells solitary, elongated spindle, nearly 10 times longer than broad, straight or seldom lightly bent. Cell ends gradually tapered to a pointed tip. Chloroplast lies adjacent to the cell wall. Pyrenoid absent. Cells $21 \mu\text{m}$ long, about $2 \mu\text{m}$ broad.

Mathbaria, Station No. 1, 16.08.2004.

16. **Ankistrodesmus bernardii** Kom. (Figs. 16-17)

(Huber-Pestalozzi 1983, 687, 193: 3a,d)

Colonial, cells in the colony form bundle, 2-8-many cells bound together in a single colony. Cells very narrow, elongated, thin, ends pointed. Many-celled colony $40.6 \mu\text{m}$ in diameter, individual cell $30.0 \mu\text{m}$ long and $0.8 \mu\text{m}$ broad.

Mathbaria, Station No. 6, 22.06.2004, 30.08.2004.

17. **Ankistrodesmus densus** Korš. (Fig. 18)

(Huber-Pestalozzi 1983, 687, 193: 2c)

Colonial, cells in the colony joined end to end and alternately to form an elongated filamentous structure. Colorless thin mucilage may be present. Colonies 101.6 μm long and 5 μm broad. Individual cells 38 μm long and 2.5 μm broad.

Bakerganj, Station No. 8, 11.07.2005.

18. **Ankistrodesmus stipitatus** (Chod.) Kom.-Legn. [Syn.: *Raphidium fasciculatus* status *stipitatus* Chod.] (Fig. 19)

(Huber-Pestalozzi 1983, 684, 191: 2b)

Solitary or in 2-4-8-celled colonies. Cells elongated, straight, very thin, sharply pointed at both ends, light green. Individual cell 40.0 μm long and 1.5 μm broad.

Mathbaria, Station No. 6, 22.06.2004.

19. **Kirchnerella irregularis** (G.M. Smith) Korš. [Syn.: *Kirschneriella lunaris* var. *irregularis* G.M. Smith] (Fig. 20)

(Huber-Pestalozzi 1983, 668, 186: 4a)

Colonial, 4-16-(32)-celled, seldom solitary. Cells in the colony are arranged in a group of 4. Individual cells bent in a half-circle fashion, spindle-shaped, at the end gradually tapered, somewhat pointed or having a blunt end. Chloroplast lies adjacent to the cell wall. A single pyrenoid may be present. Colonies 25.6 μm long and 12.9 μm broad; individual cells 5 μm long and 1.5-2.0 μm broad.

Bakerganj, Station No. 1, 15.06.2004.

20. **Tetraedron arthrodesmiforme** var. **contorta** Woloszyńska (Fig. 21)

(Prescott 1982, 263, 59: 9-10; Yamagishi and Hashizume 1989, 79, 5:18o)

Cells solitary, 4-angled, angle smooth, tipped with spine, spine single, angles in one plane. Cells deeply constricted on both sides, each of the 4 lobes tipped with a spine. Cells quadrate in outline, isthmus is bordered by a widely open sinus, 40 μm wide (including spines) and 14 μm long.

Mathbaria, Station No. 6, 30.08.2004.

Family: Coelastraceae

21. **Coelastrum indicum** Turn. (Figs. 22-24)

(Huber-Pestalozzi 1983, 737, 205: 5)

Colonies spherical, free-living, (8)-16-32-(64)-celled. Cells spherical with angled undulated margin, triangular holes present in the colony. Chloroplast single, lies adjacent to the cell wall. Colonies 34-40 μm in diameter; individual cells 4-6 μm in diameter.

Mathbaria, Station No. 6, 30.08.2004, 09.11.2004.

Family: Scenedesmaceae

22. *Scenedesmus similagineus* Hortob. (Fig. 25)

(Huber-Pestalozzi 1983, 856, 231: 5)

Coenobia 2-4-(8)-celled, linear, sometimes lightly bent. Individual cells elongated ovoid to spindle shaped, poles rounded, with small papillae like dents. Cell wall smooth. Coenobium (2-celled) $9 \times 9 \mu\text{m}$; individual cells 9 μm long and 4 μm broad.

Bakerganj, Station No. 1, 15.06.2004.

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